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ABSTRACT

A survey instrument was sent to state departments of education requesting information on: (1) teacher preparation in science and mathematics education; (2) teacher availability in these areas; (3) secondary science and mathematics curricula; and (4) recommendations for alleviating any shortages of mathematics and science teachers. Responses from all 50 states are reported and discussed. Among the findings included are those indicating: a 15-25 required credit hour range for junior high school mathematics (JHM) certification and a required credit hour range of 20-25 hours for senior high mathematics (SHM), senior high science (SHS), and junior high science (JHS); that 80 percent of states have provisions to waive/modify requirements for emergency certification; that an inadequate supply of teachers exists in most fields, expressed in percentage of shortage (JHM--75.5 percent, JHS--62.5 percent, SHM--80 percent, and SHS chemistry and physics--82.2 percent); that there is an adequate supply of biology teachers; that 60 percent expected decreased teacher supply in most areas except biology; and that respondents indicated computer science is offered in some form. Among the recommendations for alleviating teacher shortages are those related to financial considerations, recognition of special service, and provisions for retired certified teachers to teach part-time. (Complete survey results on a copy of the survey form are included.) (JM)

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THE 1983 SURVEY OF MATHEMATICS AND SCIENCE TEACHERS IN THE FIFTY STATES

By Catherine Yeotis and Kenneth Nickel

These are both hopeful and frustrating times for those who want to improve the nation's science and math education.[1] In 1981, almost five times more teachers in this area of education left the schools to take non-teaching jobs than left through retirement... America's institutes of higher learning now produce 78 percent fewer math teachers and 64 percent fewer science teachers than they did a decade ago.[2] Albert Shanker said, "The inability of schools to compete with the attractive salaries being offered by the private sector to talented young teachers is a critical problem. Ironically, industry is draining off from public education the very teachers who are doing the best job of transmitting math and science skills to future industry employees."[3] Over half of the math and science teachers in a recent study of the Greater Boston area hope to find nonteaching positions in the next two years.[4] One-third of the math and science teachers in California high schools did not graduate with even a college minor in either subject.[5] Among newly employed science and mathematics teachers, 50.2 percent were judged by principals to be unqualified to teach in those fields, but had been employed on an emergency basis because school officials could not find qualified teachers. In the Pacific States the ratings of unqualified personnel jump to 84% by the principals.[6] The State Department of Education in New Jersey has declared an emergency shortage of mathematics teachers in 17 of 21 of New Jersey's counties. This emergency designation permits districts to use unlicensed teachers - some without bachelor's degrees - to teach the subject.[7] Certified mathematics teachers who are hired by the Richmond schools receive a $2000 bonus for signing, $1500 for the first

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year and $500 the second year. Teachers who leave before two years must pay back a portion of the bonus.[8]

Yes, these are both hopeful and frustrating times for education in all fields and particularly in the fields of mathematics and science. How hopeful and how frustrating may vary from state to state and from school district to school district and from year to year. The rhetoric, pro and con, on education, in the many commission and council reports brings new and more demands for much more stress on the academics. The hopes and the frustrations of educators have never been higher and have never been more in the public eye.

It was with high hopes and significant levels of frustration that the researchers undertook to try to ascertain up-to-date information from all of the fifty states with regard to mathematics and science education. A survey instrument was sent to the state departments of education in all fifty states early in 1983. The survey form contained four distinct areas: teacher preparation in mathematics and science education, teacher availability in these areas, secondary curricula in mathematics and science, and recommendations for alleviating any shortage of mathematics and science teachers. Responses were received from all of the state departments of education. These data are reported in the following pages. Supplementary pages at the end of this report present the compilation of the responses.

Part I A. of the survey form asked for the minimum requirement in the state for secondary certification in Jr.H.S., Sr.H.S. mathematics and Jr.H.S., Sr.H.S. science and, if credit hours were required, how many hours. The responses indicated that 70.4% required credit hours while 29.6% utilized standards for Jr. H.S. mathematics. The modal response for the number of hours was in the 15- to 25-hour range. For Sr.H.S. mathematics, 71.7% required credit hours while 28.3%

utilized standards. The modal range for credit hours required was 20 to 25 hours. The responses for Jr.H.S. science indicated that 68.7% require credit hours and 31.3% had qualification by meeting standards. The number of credit hours required has a modal response of 20 to 25 hours. Sr.H.S. science certification requirements responses indicated that 69.6% required credit hours with 30.4% using standards. The modal responses for the number of credit hours required for Sr.H.S. science was 20 to 25 hours.

"Are there provisions in your state to waive or modify requirements for emergency or provisional certification?" was asked in Part I B. of the survey form. In the area of Jr.H.S. math, 82.9% indicated that such provisions were present, while 17.1% responded that they were not present. For Sr.H.S. math, 80.4% indicated such provisions were available and 19.6% that they were not. The respondents in Jr.H.S. science replied that these provisions were present in 82.6% of the states and not available in 17.4%. For Sr.H.S. science, 80.4% of the respondents indicated these provisions were present and 19.6% that they were not present. Part I C. asked if teacher education institutions used only minimum certification requirements in the four teaching fields in the survey. In Jr.H.S. math, 36.6% indicated yes while 63.4% indicated no. Sr.H.S. math elicited responses to this question of 35.7% yes and 64.3% no. In Jr.H.S. science, 35.1% replied with "yes" while 64.9% said "no." For Sr.H.S. science, 35% said "yes" and 65% replied with "no." The respondents were asked, if "yes" had been indicated about the use of minimum certification requirements, to estimate the percentage of teacher education institutions which used only the minimum requirements. These responses are presented in tabular form at the end of this article. There was no pattern of responses to this question.

These data on waiving or modifying certification requirements in mathematics and science in order to issue emergency or provisional certificates may present a partial reason for the statements earlier in this article with regard to the high percentages of such teachers deemed unqualified in the field. Obviously, there are other reasons for this unfortunate situation and the fact that it is difficult, if not impossible, to employ qualified teachers adds to the problem.

Part of the survey was concerned with the availability of secondary mathematics and science teachers. Part II A. asked if an adequate number of certified secondary math and science teachers is presently available to meet the needs in the state. In Jr.H.S. mathematics, 75.5% indicated there was not an adequate supply available. Eighty percent indicated an adequate number of such teachers was not available in Sr.H.S. mathematics. For Jr.H.S. science, 62.5% replied that an adequate supply was not available. In the Sr.H.S. area, 59.1% indicated that an adequate supply of teachers in biology was available, 82.2 responded that an adequate number of certified teachers in chemistry was not available, and 82.2% indicated that an adequate supply of physics teachers was not available.

The information from the question asking if an adequate number of

certified secondary mathematics and science teachers is presently available to meet the needs illustrates that in all areas of mathematics and science with the exception of biology there is a great need for additional, qualified teachers.

Part II B. asked each respondent to estimate the shortage of secondary mathematics and science teachers in the state as a percentage of the total number of secondary teachers in that field and at that level. Most of the responses clustered in the 5-10%, 10-15%, and 15-20% ranges. However, the modal response for physics was in the 20-25% area with one response in physics indicating 90%. Jr.H.S. and Sr.H.S. math, Jr. H.S. science and chemistry all received one response in the 70-80% range. The table of the responses to the shortage question is presented at the end of this article.

Part II C. requested that each respondent indicate the percentage of teachers teaching secondary mathematics/science courses who are not fully certified or who have emergency certificates. Most of the responses fell into the 0-5%, 5-10%, and 10-15% ranges. However, again, two responses were in the 90% range, in chemistry and general science and responses in Jr.H.S./Sr.H.S. math were in the 70-80% category. A table presenting the responses to this part of the survey form is appended at the end of the article.

The respondents in Part II D. were asked to indicate whether the need for mathematics/science teachers would increase, remain the same, or decrease in the next five years. In Jr.H.S. math, 75% replied that the need would increase, 22.7% said that the need would remain the same, and 2.3% reported that it would decrease. For Sr.H.S. math, 84.1% indicated that the need would increase, 13.6% said that it would remain the same, and 2.3% replied that it would decrease. The respondents in Jr.H.S. science indicated the need would increase with 71.1%, remain the same with 26.3%, and decrease with 2.6%. In the Sr.H.S. sciences, 60.5% said the need in biology would increase and 39.5% reported that it would remain the same; 85.7% responded that the need in chemistry would increase, 11.9% replied it would remain the same and 2.4% indicated that the need in chemistry would decrease; in general science, 65.1% responded that the need would increase and 34.9% said it would remain the same; 76.1% replied that the need would increase in physics, 15.2% that it would remain the same and 8.7% that it would decrease; and in earth science, 85.7% indicated that the need for such teachers would increase with 14.3% that it would remain the same.

A companion question to the need request was contained in Part II E. on whether the supply of mathematics/science teachers would increase, remain the same or decrease. In Jr.H.S. math, 54.3% indicated that the supply of such teachers would decrease, 28.3% that it would remain the same and 17.4% that it would increase. In Sr.H.S. math, 60.9% responded that the supply would decrease, 19.55% that it would remain the same and 19.55% that it would increase. In Jr.H.S. science, 44.2% of the respondents indicated that the supply would decrease, 41.8% that it would remain the same and 14% responded that the supply of Jr.H.S.

science teachers would increase. At the Sr.H.S. science level, in biology 18.6% of the respondents said the supply of teachers would increase, 55.8% indicated it would remain the same, and 27.6% replied that the supply of biology teachers would decrease; in chemistry, 18.6% indicated the supply would increase, 20.9% said it would remain the same and 60.5% replied that the supply of chemistry teachers would decrease; 13.9% f the respondents said that the supply of general science teachers would increase, 53.5% indicated it would remain the same and 32.6% responded that the supply would decrease; in the physics area, 19.1% indicated that the supply would increase, the same per cent reported the supply would remain the same, and 61.8% said the supply of physics teachers would decrease; in earth science, which some respondents added, 12.5% indicated the supply would increase, 25% said it would remain the same and 62.5% of those adding this item indicated the supply of earth science teachers would decrease.

The survey results with regard to the availability of teachers in mathematics and science, the projected need and supply and the numbers of teachers not fully certified present a present and future difficult for educators in the fields of mathematics and science. If curricula as indicated in the next section are to be continued and recommendations for more math and science are to be implemented, much must be accomplished to train and retain good teachers in these fields.

In Part III A., respondents were asked to indicate the courses in mathematics and various sciences which were presently offered in one or more secondary schools. Forty-eight of the 50 respondents checked trigonometry, analytic geometry, calculus I, chemistry and earth science while 49 marked physics. Forty-seven indicated that biology and advanced biology were offered; 44 listed college algebra and general science with 43 checking advanced chemistry. Other math and

science were listed by fewer respondents with many being added to the survey list. Those that were added by three or more respondents are included on the survey form copy attached to this article.

Respondents were asked in Part III B. if courses in computer science and/or microcomputing were offered as part of the secondary mathematics and/or science curriculum. Forty-five of the respondents indicated that such courses were offered as part of the secondary mathematics program and 30 responded that these courses were offered as part of the secondary science program.

In Part III C., respondents were asked if computer science and/or microcomputing courses were offered as separate courses. Forty-four of the respondents answered in the affirmative and one in the negative. It is presumed that courses in computer science and/or microcomputing will increase in the very near future.

Part IV asked respondents to record their personal recommendations for alleviation of the shortage of mathematics/science teachers. The suggestions were listed with the respondents requested to indicate whether they favored, did not favor, or had no opinion on the suggestions. Space was provided for additional ideas. All of those that responded to the idea of lowering certification requirements in math/science indicated they did not favor this idea (46 responses). On utilizing emergency certification procedures, 39.1% of the 46 respondents favored the idea. 56.5% did not favor it and 4.4% marked no opinion. Forty-seven respondents favored providing stipends to upgrade the skills of math/science teachers (97.9%) and 2.1% had no opinion. Providing stipends/tuition grants for teachers to attain math/science certification elicited 95.8% in favor, 2.1% did not favor and 2.1% had no opinion. Providing forgivable loans to

prospective math/science teachers had 97.8% in favor and 2.2% with no opinion. Increasing salaries for all teachers had 95.8% in favor and 2.2% with no opinion. Increasing salaries for all teachers had 95.8% in favor and 4.2% not in favor. The other ideas listed had a fairly balanced response between "favor" and "do not favor." Several additional suggestions were made, among which was: (State/ Federal) income tax credit for educators. The tabular responses to the ideas listed and the additional suggestions are included at the end of this article.

Some of the obvious conclusions which can be drawn from this study are that there is a shortage of math/science teachers and that it appears the shortage will get worse in the near future, that unqualified teachers in these subject areas are being employed because of the shortage and that there is an urgent need to prepare more qualified math/science teachers and to retain them in the teaching profession. Another conclusion which can be deduced from the responses to the recommendations for alleviation of the shortages is that teacher salaries must be increased in order to attract more persons into these teaching areas and to keep good teachers in these areas from leaving the classroom for better jobs in business and industry. The curricula offered in the several states in mathematics and science seemed to be sufficient if such courses were available in many localities in each state. Currently, there is increased emphasis on requiring more years of study in math and science. Any increases in these requirements will exacerbate the shortage of qualified teachers in these fields.

It appears that changes such as lengthening the school day or year, increasing the math/science requirements and requiring competency tests for both teachers and graduating high-school students do not address the major problem -

that of getting and keeping qualified teachers. A statement in a recent article on educational problems confirmed this idea: "The most ambitious plans for longer school days, more demanding courses and higher standards are meaningless without teachers who can make school worth attending."[9] Only by increasing teacher salaries to a more competitive level with industry can an adequate supply of certified, qualified math/science teachers be maintained. Another aspect of the current math/science problem is that of increasing interest in these fields in students and of overcoming problems such as math anxiety. Of course, outstanding, qualified teachers will do much to resolve this problem. However, additional efforts to promote excellence in mathematics and science are being promulgated. One example of these efforts is the Mathcounts program, a nationwide effort of industry, education and government. This effort, which is a cooperative project of the National Society of Professional Engineers, the National Council of Teachers of Mathematics, the CNA Insurance companies, and the National Science Foundation is designed to elevate the level of prestige associated with mathematics achievement among students in grades 7 and 8, to increase the general public's awareness of the importance of mathematics and to improve mathematics curricula in grades 7 and 8 throughout the United States.[10] The NSTA-NASA Space Shuttle Student Involvement Program is another example of an effort to involve students in activities which promote interest in science. This program offers students the unique opportunity to propose space experiments to be performed aboard the Space Shuttle with awards to all entrants and to regional and national winners.[11] Activities such as these two cited ones can be part of a long-range program to promote interest and activity in mathematics and science and can lead to more persons becoming educated in these fields. Presumably, if more people participate in mathematics and science, more people will become teachers in these fields.

References

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2. "Addressing the Trickle and the Flood," The Harvard Graduate School of Education Association Bulletin, Spring/Summer, 1983, Midcareer Math & Science Program, page 11.

3. Beverly T. Watkins, "Easing of Science-Teacher Shortage Eyed," The Chronicle of Higher Education, January 5, 1983, page 10.

4. The Harvard Graduate School of Education Association Bulletin, Ibid.

5. "Low-Tech Teaching Blues," Time, December 27, 1982, page 67.

6. "Mathematics Teacher Shortage," NCTM Fact Sheet, M/9/82/2385A (Star-Ledger, September 13, 1982).

7. "Mathematics Teacher Shortage," NCTM Fact Sheet, M/9/82/2385A (Star-Ledger, September 13, 1982).

8. "Mathematics Teacher Shortage," NCTM Fact Sheet, M/9/82/2385A (Star-Ledger, September 13, 1982).

9. "Education: The Bold Quest for Quality," Time, October 10, 1983, Page 63.

10. Mary H. Jones, "MATHCOUNTS: A New Junior High School Mathematics Competition," The Mathematics Teacher, October, 1983, page 482.

11. Brochure from The National Science Teachers Association, 1742 Connecticut Avenue N.W., Washington, D.C. 20009

I. Preparation of Secondary Teachers in Mathematics and Science.

A. What is the minimum requirement in your state for secondary certification in the teaching areas listed below? (Please indicate the number of credit hours required in the teaching area or, if standards are to be met, check that designation. A copy of the standards should be included if possible.)

Jr.H.S. Math-No. of Credit Hrs. 38 Jr.H.S. Science-No. of Credit Hrs. 33

Standards Used 16 Standards Used 15

Sr.H.S. Math-No. of Credit Hrs. 33 Sr.H.S. Science-No. of Credit Hrs. 32

Standards Used 13 Standards Used 14.

A TABLE OF REQUIRED CREDIT HOURS(I. A) IS PRESENTED ON THE LAST PAGE.

B. Are there provisions in your state to waive or modify these requirements for emergency or provisional certification?

Jr.H.S. Math-Yes 39, No 8. Jr.H.S. Science-Yes 38, No 8.

Sr.H.S. Math-Yes 41, No 10** Sr.H.S. Science-Yes 41, No 10**

**Some respondents marked both designations.

If yes has been designated in any of the above, please provide waiver/modification details. Inclusion of a copy of these procedures would be helpful.

C. To your knowledge, do any teacher education institutions in your state use only the minimum requirement in the subject areas listed below as the standard for recommending secondary certification in that area?

Jr.H.S. Math-Yes 15, No 26. Jr.H.S. Science-Yes 13, No 24.

Sr.H.S. Math-Yes 15, No 27. Sr.H.S. Science-Yes 14, No 26.

If yes is indicated in any of the above, please estimate the per cent of the teacher education institutions in your state which use only the minimum subject area requirements for recommending for secondary certification in that subject.

A TABLE OF THESE PER CENT RESPONSES (I. C) IS PRESENTED ON THE LAST PAGE.

Jr.H.S. Math ___% Jr.H.S. Science ___%

Sr.H.S. Math ___% Sr.H.S. Science ___%

Comments: _____

_____

II. The Availability of Secondary Mathematics and Science Teachers.

A. Is an adequate number of certified secondary mathematics and science teachers presently available to meet the needs in your state?

Jr.H.S. Math-Yes 11, No 34.

Sr.H.S. Math-Yes 9, No 36.

Jr.H.S. Science-Yes 15, No 25.

Sr.H.S. Science	Yes	No
Biology	26	18
Chemistry	8	37
Gen. Science	20	25
Physics	8	37
Other ___ ___	___	___

(Please Conti on Pages 3 & 4)

B. In each area marked no in A, please estimate the shortage of secondary mathematics and science teachers in your state as a per cent of the total number of secondary teachers in that field and at that level in your state.

A TABLE OF THESE RESPONSES IS PRESENTED ON THE LAST PAGE. (II. B)

Jr.H.S. Math ____%

Sr.H.S. Math ____%

Jr.H.S. Science ____%

Sr.H.S. Science-Biology ____%
Chemistry ____%
Gen.Sci. ____%
Physics ____%
Other _____ ____%.

C. Please indicate the per cent of teachers who are teaching secondary mathematics/science courses in your state who are not fully certified or who have emergency certificates in the following subject areas:

A TABLE OF THESE RESPONSES (II. C) IS PRESENTED ON THE LAST PAGE.

Jr.H.S. Math ____%

Sr.H.S. Math ____%

Jr.H.S. Science ____%

Sr.H.S. Science-Biology ____%
Chemistry ____%
Gen.Sci. ____%
Physics ____%
Other _____ ____%.

D. From the information currently available to you, will the need for secondary mathematics and science teachers increase, remain the same, or decrease in your state in the next five years (1983-1988)?

Jr.H.S. Math	Increase	33
	Same	10
	Decrease	1
Sr.H.S. Math	Increase	37
	Same	6
	Decrease	1
Jr.H.S. Science	Increase	27
	Same	10
	Decrease	1

Sr.H.S. Science	Incr.	Same	Decr.
Biology	26	17	0
Chemistry	36	5	1
Gen.Sci.	28	15	0
Physics	35	7	1
Other Earth Sci.	6	1	0
Computer Sci.	1	0	0
Sci./Society Tech.	1	0	0

E. From information currently available to you, will the supply of secondary mathematics and science teachers increase, remain the same, or decrease in your state in the next five years (1983-1988)?

Jr.H.S. Math	Increase	8
	Same	13
	Decrease	25
Sr.H.S. Math	Increase	9
	Same	9
	Decrease	28
Jr.H.S. Science	Increase	6
	Same	18
	Decrease	19

Sr.H.S. Science	Incr.	Same	Decr.
Biology	8	24	11
Chemistry	8	9	26
Gen.Sci.	6	23	14
Physics	8	8	26
Other Earth Sci.	1	2	5

Comments: _____

_____

(Please continue on Page 4)

III. Curriculum in Secondary Mathematics and Sciences.

A. Please check all courses below that are presently offered in your state in one or more secondary schools. Other sciences with 3 or more responses ar listed be

Mathematics		Science			
Trigonometry	48	Biology	47	Physics	49
College Algebra	44	Adv. Biology	47	Adv. Physics	35
Analytic Geometry	48	Chemistry	48	Earth Sci.	48
Calculus I	48	Adv. Chemistry	43	Adv. Earth Sci.	19
Calculus II	32	Gen. Science	44	Oceanography	3
Other Prob./Stat.	4	Other Ecology	3	Anat./Physio.	3
		Environ. St.	3	Botany 3	Physical Sci. 3

B. At the present time in your state, are courses in computer science and/or microcomputing offered as part of the secondary mathematics and/or secondary science curriculum?

Mathematics 45

Science 30.

C. Are courses in computer science and/or microcomputing offered as separate courses at the present time in your state?

Yes 44

No 1.

Comments: _____

_____

IV. Recommendations for Alleviation.

In view of the current supply of mathematics and science teachers at the secondary level, please indicate your personal recommendations on each of the following suggestions for alleviating the shortage. (Please mark your reaction on each of the following.

	Favor	Do Not Favor	No Opinion
1. Additional Salary for Math/Sci. Teachers	1. 25	18	3
2. Provide part-time teachers from industry	2. 22	21	3
3. Lower secondary certification requirements in mathematics and science	3. 0	46	0
4. Utilize emergency certification procedures	4. 18	26	2
5. Increase salaries for all teachers	5. 45	2	0
6. Provide a merit pay system for teachers	6. 27	10	9
7. Provide stipends to upgrade the skills of math/science teachers	7. 47	0	1
8. Provide forgivable loans to prospective math/science teachers	8. 46	0	1
9. Pay a bonus to math/science teachers when they sign a contract to teach	9. 20	21	7
10. Provide stipends/tuition grants for teachers to attain math/science certificat'n	10. 46	1	1
11. Other _____	11. ____	____	____
12. Other _____	12. ____	____	____

OTHER RECOMMENDATIONS (IV.) ARE LISTED ON THE BACK OF THE LAST PAGE.

PLEASE CHECK IF YOU WISH TO RECEIVE A COPY OF THE RESULTS ____

Please return as soon as possibl in the en sed envelope to Drs. Yeotis/Nickel Box # Wichita te University, Wichita, KS 67208

A SURVEY OF MATHEMATICS & SCIENCE EDUCATION IN THE UNITED STATES

Section I. A — Number of Required Hours for Secondary Certification

	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50 or More
JHS Mathematics	1	1	1	14	14	2	1	1	0	0	0
SHS Mathematics	0	0	1	9	16	3	5	1	1	0	0
JHS Science	1	1	0	8	11	1	4	3	0	1	0
SHS Science	0	0	0	6	13	1	6	3	1	1	1

Section I. C — Per Cent Using Only the Minimum Subject Area Requirements

JHS Mathematics	17%-1	25%-1	40%-1	60%-1	75%-2	80%-2	100%-2
SHS Mathematics	5-10%-2	19%-1	25%-1	60%-1	67%-1	90%-1	100%-2
JHS Science	25%-1	50%-1	60%-1	75%-1	100%-2		
SHS Science	5-10%-1	25%-1	50%-1	60%-1	67%-1	100%-2	

Section II. B — Estimated Per Cent of Shortage of Mathematics & Science Teachers in the State

	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-70	70-80	80-90	90---
JHS Mathematics	2	6	6	3	3	0	1	1	0	0	0	3	1	0	0
SHS Mathematics	5	4	5	6	3	0	2	1	1	0	0	0	1	0	0
JHS Science	1	4	6	1	0	2	1	1	2	0	0	0	1	0	0
SHS-Biology	3	4	1	4	3	0	1	0	0	0	0	0	0	0	0
Chemistry	4	5	5	2	4	2	4	0	1	0	0	0	1	0	0
Gen.Sci.	3	5	4	3	1	0	0	0	2	0	0	0	0	0	0
Physics	3	5	3	3	7	2	1	0	2	0	0	1	0	0	1
Earth Sci.	1	2	1	1	1	0	0	0	0	0	0	0	0	0	0

Section II. C — Per Cent of Teachers in Mathematics and/or Science Course Who Are Not Fully Certified or with Emergency Certificates

	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-70	70-80	80-90	90---
JHS Mathematics	5	5	5	2	2	2	0	1	1	1	0	1	2	0	0
SHS Mathematics	8	4	9	1	1	3	0	0	0	0	1	1	1	0	0
JHS Science	5	4	4	3	0	0	1	0	3	1	0	0	0	0	0
SHS-Biology	9	3	4	0	2	1	2	0	0	0	0	0	0	0	0
Chemistry	8	2	6	3	1	2	2	1	0	0	0	0	0	0	1
Gen.Sci.	7	4	5	1	1	1	1	0	1	0	0	0	0	0	1
Physics	8	3	3	3	3	3	2	0	1	0	0	1	0	0	0
Earth Sci.	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0

IV. ADDITIONAL RECOMMENDATIONS FOR ALLEVIATION.

Provide opportunity and encouragement for retraining of established teachers.
Make provisions for retired certified teachers to teach part time.
Recognition of special talents.
See recommendations contained in proposals by the Nat'l Assoc. of Sec.Sch.Princ.
Recognition of special service.
Massive inservice for current faculty.
Significant pay increase (60% or so) for all teachers.
Retrain teacher surplus (e.g. Soc.St./Health/PE) to meet Math/Sci. quotas.
State level teacher corps to be sent to need areas of the state.
Extended (summer) employment.
Summer employment in business and industry.
Part-time jobs in industry.
Enhance the social status of teachers.
(State/Federal) income tax credit for educators.
Shortages will not be eliminated without financial considerations.
Improve attractiveness of teaching.
Special recognition for excellence.
Increased positive media coverage of the benefits of choosing science or mathematics education as a career.
Industrial employment in summer.
Extended school year.
Upgrade all areas of education equally.